

# **Petrol And Natural Gas Distribution Lines In Turkey And Cartography Studies**

**Sabahattin AKKUŞ, Hasan ÇAĞLA, Fuat BAŞÇİFTÇİ and Turgut AYTEN and Ismail Hakkı ÇİCEK, Turkey**

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## **SUMMARY**

BOTAŞ (Petroleum Transfer through Pipe Lines Joint-Stock Company) is the first remembered name about pipe lines in Turkey. BOTAŞ which was established under the institution of TPAO (Turkish Petroleum Joint-Stock Company) to transfer petrol from Kerkuk Region in Iraq to the sea terminal Adana-Ceyhan in Turkey was transformed into the Independent Economic Enterprise in 1995, and it has begun to operate 3400 km. petrol pipe line with Baku-Tbilisi-Ceyhan line and 5000 km. natural gas pipe line since 1974. International projects has been carried out besides petrol and natural gas transfer and distribution lines in Turkey. Making Turkey an energy corridor has aimed institutionally by the projects which are carried out with national and international enterprises.

Searching the pipe lines on land, determining the destinations, making the nationalisation maps and forming the geodesic nets based on the GRS 80 Ellipsoid that are appropriate to the lines has been carried out by surveyors. Cadastral map sheets in different layouts and different scales were produced according to the different laws in establishment cadastre studies in Turkey. Big problems has been faced in the stage of the application of the pipe lines to the land which passed on the layouts.

In this study, information will be given about the petrol and natural gas distribution lines which are carried out by BOTAŞ in Turkey which is acting as a bridge between the Asia and Europe, mapping studies on the transfer and distribution lines of the institution which took on the active duty in saving the natural gas underground and open it to the world, establishing geographic information systems.

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## **1. INTRODUCTION**

Obtaining clean, cheap and safe way of energy which is one of the most important parameters in development of nations is a current issue of all the countries. However, it is seen that the concept of “continuous development” has taken its place, the cost and the future of renewable energy resources has been discussed while the competition among the energy resources are going on, and the countries which have insufficient energy resources have produced policies to determine which energy resources and in what degree of priority should be given.

In Turkey a long term policy on continuable development and energy couldn't be constituted. But, natural gas importation has been revised in last period because of the economy and it is explained that the priority would be given to the domestic resources. Undoubtedly, the social aspect of the issue is also important. It is obvious that there aren't enough domestic energy resources except potential hydraulic and coal reserves in Turkey, and scientific studies on other resources are either insufficient or they are far of usage.

As a result of increasing population in the world and in our country and technological developments, energy demand has increased day by day (Köse,2002).

The energy demand in our country has made a study of long term planing a current issue. However, the air pollution which started after 1980 in big cities in Turkey increased in following years, and forced the authorized people and the institutions to take precautions.

Geographic position of Turkey has given a chance of being an Energy Terminal in 21st century like a Silk Road in history. Experts say that the events will guarantee the energy needs and will also contribute the economy. Turkey with its young population and developing economy has used the advantage of its geopolitical position and has imported petrol and natural gas from the countries of the Central Asia which have rich underground resources. By this way Turkey has covered its energy needs, and has joined the projects which will constitute a new energy corridor opening to Europe by international pipe lines.

## **2. BOTAS (PETROLEUM TRANSFER THROUGH PIPELINES JOINT STOCK COMPANY)**

BOTAŞ (Petroleum Transfer through Pipe Lines Joint-Stock Company) is the first remembered name about pipe lines in Turkey.

Botas, Petroleum Pipeline Corporation was established as an affiliated company of Turkish Petroleum Corporation (TPAO) on August 15, 1974 in order to transport Iraqi crude oil to the Gulf of Iskenderun. In 1995, the company was restructured as a State Economic Enterprise (SEE) considering the company's task at present and in future. Botas's business in transportation of crude oil by pipelines has expanded to cover the natural gas transportation and trade activities since 1987.

In early years of its foundation, the duty of BOTAS was construction of all kinds of pipe lines in Turkey and in other countries, administration of the pipe lines, transferring petrol and natural gas through the lines, and buying and selling petrol and natural gas. In 1995 its duty was widened by adding all kinds of petrol activities like searching petrol, opening oil wells, oil production, transferring, storing, and processing foreign petrol and natural gas.

BOTAS has begun to operate 3400 km. petroleum pipeline with Baku-Tbilisi-Ceyhan pipeline and 5000 km. natural gas pipeline since 1974. The total length of the pipe lines reached 8000 km with the continuing projects at the end of 2005. International projects- BTC Crude Oil Pipeline, Shah Sea Natural Gas Pipeline, Turkey-Greece Turkish Part of Natural Gas Pipeline- has been carried out besides petroleum and natural gas transfer and distribution lines in Turkey. BOTAS has been planned to carry out the projects of Turkey-Austria Natural Gas and Samsun-Ceyhan Petroleum Pipeline.

Headquartered in Ankara, BOTAS is organized throughout the Country in order to operate oil and natural gas systems efficiently by focusing on customer based activities. This network will develop more as new pipelines are becoming operational. The organizational structure of the Company is mainly comprising structures for natural gas and crude oil systems. BOTAS International Ltd. was established in 1996 for the purpose of efficient participation in the international energy projects. BOTAS is also participated in TURUSGAZ holding 35% through which an additional gas is imported from the Russian Federation (URL 1).

Natural gas, underground storage projects and constructions on appropriate places has been carried on for serving the increasing needs due to the weather conditions in winter by storing extra supply of summer (Tozlu, 2005).

The investments made by BOTAS are:

- Transfer Lines
- Loop Lines
- Distribution Lines and Connection Lines
- Continuing Transfer Lines
- Continuing Distribution and Connection Lines

National and International projects:

- Baku-Tbilisi-Ceyhan COPL Project

- Turkey-Greece NGTL Project
- Transcaspian Türkmenistan-Turkey Europe NGTL Project
- Azerbaijan-Turkey NGTL Project
- Iraq-Turkey NGTL Project
- Egypt-Turkey NGTL Project
- Turkey-Bulgaria-România-Hungary-Austria NGTL Project (Nabucco Project)
- Eastern Black Sea NGTL Project
- Western Black Sea Project
- Natural Gas Underground Storage Project

Making Turkey an energy corridor has aimed by the projects carried out with national and international enterprises (Şahin, 2005).

National and International petroleum and natural gas pipelines constructed by BOTAS can be seen in Map1



**Map 1:** National and International petroleum and natural gas pipelines constructed by BOTAS

### 3. PIPELINES AND CARTHOGRAPHY

Although liner projects like pipelines are easily defined by putting a certain pipe which has a certain diameter and feature underground through the certain destination that has a start and finish point, in fact it includes intensive activities of planning, engineering, nationalization, obtaining material and construction.

It is probable that things to be done generally are classified as follows in order to determine the duty areas of mapping and cadastral survey. First of all, there will be a contract including the financial, legal and technical substructure and there will be the preparation process of the contract. Geodesy and Photogrammetry Engineers are needed to take part in especially study of the project, obtaining land, engineering and construction (Çiçek, 2005).

Projects, awarding procedures of pipelines, engineering works, study map and nationalisation engineering services have been done according to the terms in the “Technical Contract of Study Map and Nationalisation Engineering Services” which was prepared by BOTAS.

They are divided into five categories:

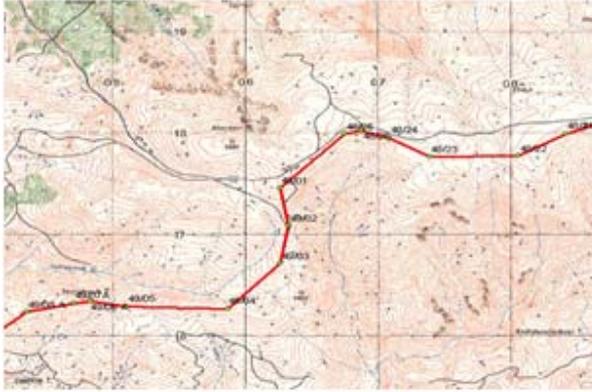
- Route Determination Study
- Establishing and Surveying the Land Control Points
- Cartography Studies
- Preparation of the Nationalisation Maps
- Work in the Construction Level

#### **4. ROUTE DETERMINATION STUDY**

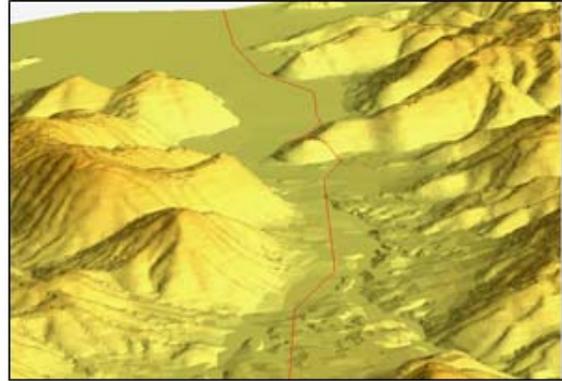
In route studies, the 1/25000 scaled maps are used in offices and criterions of pipeline construction technique have been taken into the consideration. In the studies whether there are geological researches, state projects on the way of the pipeline that can be a problem, establishments etc. or not are searched. The route is determined according to the results of the geological researches and the studies. Environmental Effect Evaluation Positive Certificate is tried to get for the lines of pipes which are 24” or more in diameter. These criterions are used (Öztürk, 2005):

1. Preliminary study of route in the office and on land.
2. Pipeline construction technique and route determination criterions.
3. State researches.
4. Environmental Effect Evaluation studies if possible.

Studies of the route determination (picture1,2) (Öztürk, 2005).



**Picture 1**



**Picture 2**

## **5. ESTABLISHING AND SURVEYING THE LAND CONTROL POINTS**

As a result of the route determination study;

- Tape present time map of the route,
- Profile Alignment Sheet ,
- Preparing Special Transition Maps,
- Preparing Nationalisation Maps, which are the basic works of Establishing and Surveying of the Land Control Points that are in the Regulations of Drawing Large Scale Maps are prepared by using GPS (Global Position System).
- GPS technique is used in Land surveys of nationalisation plans to determine Basic GPS Network, Densification GPS Network, serial triangulation and determining the coordinates of some of the points. The values obtained from ITRF 96 System are transformed and matched with the present entries ( BÖHHY, 2005).

## **6. MAPPING**

The following are done related with the land control points:

- Tape present time map of route,
- Constant Maps like valve and Pig Station,
- Special Transition Maps,
- Profile Alignment Sheet.

### **6.1. Tape Present Time Map of Route**

It is surveying the present time borders including definite distance of the right and left side of the route related to the control points in definite gaps and the probable establishments and the land where its structure changed. 3 Dimensions-x, y coordinates and height- of the land are determined from the surveys, changing on route without wasting time on land, calculations of

filling and cutting, seeing the land in details in office can be easily seen by this map.

## **6.2 Present Time Map of Establishments**

This study includes same activities above. The places to cut filled and flattened and their amounts are determined according to the maps, and after these studies settlement plans are prepared.

## **6.3. Special Transition Maps**

It includes drawing the maps showing the required special crossings like roads, railways, rivers and streams, and shows the present condition.

## **6.4. Profile Alignment Sheet**

The values of x, y, and z which are 3 dimensional coordinates and horizontal and oblique distances are determined by measuring once in every 50 m on pipeline axle according to the land control points and the places where the topography of the land changes.

Profiles are in 1/5000 horizontal, 1/500 vertical scales and include;

- Tape Present Time Map of the Route,
- Horizontal and oblique distances of the route and height of the distances which pass over the pipeline,
- Shows special transition points and establishments,
- Thickness of pipes,
- Geological structure of the land.

## **7. PIPELINES AND NATIONALISATION:**

Nationalisation is buying an ownership of personal real properties and resources or sharing it for the benefit of public by paying cash by the government and juristic person of public according to the principles and rules.

### **Components and Conditions of the Nationalisation**

#### **1- Benefit of the Public**

Nationalisation is a concept which put forth to prevent the misuse of the right of the authority, because it is a damaging process over ownership that guaranteed by constitution. The work can be accepted as a benefit of the public if it takes place in law and ordered to be done and included works of administration. Thus taking the decision of the benefit of the public is an administrative process, it is dependent upon the control of the judgement. If the decision of nationalisation had taken although there was no public benefit, the owner of the real property could have brought a suit to administrative court against the decision.

## **2- Decision and Approval by the Competent Authority**

## **3- Obeying the Procedure and Bases in the Law**

## **4- Paying in Cash**

Direction that makes the nationalisation have to pay the amount of nationalisation in cash to the owner except some of the circumstances took place in the Constitution and Nationalisation Law. Paying in cash means paying the money to the owner in cash or put it into his bank account.

## **5- Immovable Subjected to Private Ownership**

Nationalisation can be done only to the immovable subjected to private ownership.

### **Immovable which are public property can't be nationalised:**

Pastures,  
Mountain Pastures,  
Sheltered Places where nomads and their flocks go in winter,  
Lands in Coal Basins (Ereğli),  
Properties of which nationalisation is forbidden by a special law (Rail Roads of Turkish Republic),  
Properties Nationalised before.

Nationalisation Authorisation is a public power that can be used in the name of public by the institutions took place in 5th clause of the law. The authorized institutions of Nationalisation can make nationalisation on the condition of using it in their duty limits and for the public benefit.

BOTAŞ (Petroleum Transfer Through Pipe Lines Joint-Stock Company) is a state-owned economic enterprise which was authorised to import petroleum and natural gas and transfer through pipelines to consumption points. It has the authorisation of nationalisation in order to carry out its activities (Yürekli, 2005).

BOTAS makes share right Nationalisation on the pipeline route, and makes ownership nationalisation to the constant establishments (RMS, valve, role station, etc.).

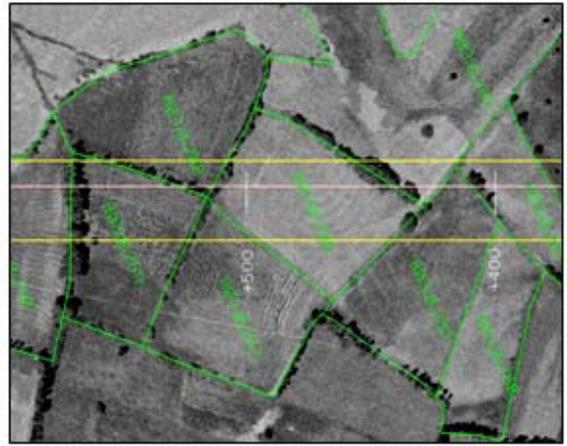
Share Right nationalisation is regulated according to the 4th clause of the Nationalisation Law. Managements are allowed to share right nationalise if it is not necessary to nationalise immovable properties or it has a great expense.

A management has a right of a certain part, height, depth or resources of the immovable which is subject to nationalisation. In this situation the owner of property which is shared by the management has to abandon some of his unlimited rights.

During the sharing right nationalisations carried out by BOTAS, owner of the land is allowed to do his agricultural activities after construction on the condition of not building constant establishment because the natural gas pipes constructed approximately 1,5 m beneath the surface in construction step.(Picture 3,4)



**Picture 3**



**Picture 4**

Fundamental system amendments were done in 2942 Issued Nationalisation Law in May 2001 by 4650 Issued Law:

In the former law, the prices of the nationalised parcels were determined by the valuing committee of the city or district and were conveyed to owners by notary. If there was an objection, the owner could bring a suit against the management.

With the amendment in the law, priority is given to buying consently. Prices of the nationalised parcels are determined by the valuing committee founded by the management and the value of the immovable is posted to the owner with registered letter and invited to bargaining. Management tries to reach an agreement by the reconciliation committee established in management. If both sides come to an agreement, the management buys the properties consently. If there is no agreement management brings suit against the owners to Fundamental Law Court.

The table below shows the amounts of Nationalisations done for Petroleum and Natural Gas Lines.

<b>PIPE LINES</b>	<b>LENGTH (Km)</b>
KONYA-ISPARTA	267.56
SİVAS - MALATYA	189.60
MALATYA-GAZİANTEP	243.50
GAZİANTEP-ADANA-MERSİN	282.87

TURKEY– GREECE	211.09
HORASAN - PT1	217.00
EAST BLACK SEA	303.00
EAST ANATOLIA NATURAL GAS PIPE LINE	1 423.24
RUSSIA FEDERATION - TURKEY	732.00
SAMSUN ANKARA NATURAL GAS PIPE LINE	500.70
PHASE LINES	1 072.60
OTHER(TRANSFER AND CONNECTION LINES)	562.45
IRAQ TURKEY PETROL LINE	625.00
CEYHAN KIRIKKALE PETROL LINE	488.00
BATMAN DÖRTYOL PETROL LINE	485.00
BAKU-TBILISI-CEYHAN PETROL PIPE LINE	1 076.00
<b>TOTAL</b>	<b>8 679.60</b>

**Table 1:** Nationalisations done for Petroleum and Natural Gas Lines (Yürekli, 2005)

## 9. WORKS IN CONSTRUCTION STAGE

Pipeline works are started with taking off the surface and flattening the delivered lands to put it into proper condition for work. In this stage, nationalised pipeline axle with working directions in engineering step and borders of the construction corridor are applied to the land. Construction activities are kept in the borders of the nationalised land carefully. The jobs are carried on respectively, lining up the pipes, opening a channel, welding, putting the pipes into the channel and as-built survey activities. After the needed tests about the pipeline construction technique applied, channel is filled and the land is worked to put into its former condition. Either in taking off the surface or in opening the channel fertile upper soil and lower soil is separated and the same process is repeated in filling the channel. Pipeline construction techniques which are needed in building establishments on land, are used.(Picture 5,6)



**Picture 5**



**Picture 6**

## 10. EVALUATION

Standards on security and environmental subjects, and applications wanted in the agreement of the project are carried out in the whole work, and special emphasis is given to the public relations. Works which are done below in construction are in field of Geodesy and Photogrammetry Engineering (Çiçek, 2005).

- Bringing the studies of obtaining land to conclusion which is the basics of delivering land according to the construction improvement plan, and delivering the places of land.
- Controlling and following the construction of road, water, energy transmission lines for establishments.
- Determining the products and paying to the land owners before entering the land.
- Following the route changes occurred from natural and technical needs in construction, and making additional nationalisation studies.
- Making additional surveys and measurements which are to be needed in construction.
- Application of the pipeline axle and construction corridor to the land, following and making the job like taking off surface and opening channel according to the nationalisation maps.
- Joining and dividing lands in development plan for establishments, and making land application according to the project.
- Solving the problems, answering the complaints in the process of obtaining land.
- Measuring the as built, controlling and putting in the archives of the whole pipeline
- Making the statistical survey of the establishments.
- Planning and carrying out the leaving from hired land for construction after completing the construction and putting the land into its former situation.
- Making additional nationalisations that can be occurred in administration process, solving the problems.
- Making location based studies and determinations of the applications of emergency operation plans.

- Determining and eliminating the violation to the security of the pipeline that can be occurred from the third person
- Geographic Information Systems (GIS) have been used in substructure applications intensively like in many fields. Interrogations and analysis on being dependent of the substructure applications with each other and being able to use in next years can be done with GIS (Duran and Seker, 2005).

## 11. CONCLUSION

In pipeline transferring which is one of the great national and international investment projects that has a great importance in transportation of energy resources, and the research, multi research, engineering and construction activities, and establishing spatial informational systems of the projects connected to geodesic network of the country are directly or indirectly interested the Geodesy and Photogrammetry Engineers, and they are needed to take more active roles in the considered projects.

## REFERENCES

- Büyük Ölçekli Harita ve Harita Bilgileri Üretim Yönetmeliği, 2005. Ankara
- Çiçek, Y.**, 2005. Boru hatları ve Jeodezi Fotogrametri Mühendisliği, TMMOB Harita ve Kadastro Mühendisleri Odası Harita Bülteni sayı:59,
- Duran, E., Seker, D., Z.**, 2005. Coğrafi Bilgi Sistemleri ile Doğal Gaz Uygulamaları ve Analizleri, TMMOB Harita ve Kadastro Mühendisleri Odası 10. Türkiye Harita Bilimsel ve Teknik Kurultayı, 28 Mart – 1 Nisan 2005, Ankara
- Köse, F.**, 2002. Yenilebilir Enerji Kaynakları, Ders notları, Konya
- Öztürk, H., İ.**, 2005. Doğalgaz ve Petrol Boru Hatlarında Haritacılık Çalışmaları, 1. Ulusal Konya Doğalgaz Sempozyumu ve Sergisi, 16 – 17 Mayıs 2005, Konya
- Şahin, Ş.**, Türkiye İletim ve Dağıtım Hatları, 1. Ulusal Konya Doğalgaz Sempozyumu ve Sergisi, 16 – 17 Mayıs 2005, Konya
- Tozlu, E.**, Doğalgaz Yeraltı Depolama Ve Botaş'ın Yeraltı Depolama Projeleri, 1. Ulusal Konya Doğalgaz Sempozyumu ve Sergisi, 16 – 17 Mayıs 2005, Konya
- Yürekli, Z.**, 2005. Türkiye'nin iletim, dağıtım hatları ve kamulaştırma, 1. Ulusal Konya Doğalgaz Sempozyumu ve Sergisi, 16 – 17 Mayıs 2005, Konya
- URL 1.** [www.botas.gov.tr](http://www.botas.gov.tr)

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